THE
SCIENTIFIC AND LITERARY REVIEW,
AND RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
Journal of the Inventors' Institute.

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VOL. IX.—No. 1.] [NEW SERIES.] JANUARY 1, 1874. [PRICE 6d.

⁂ *Communications to the Editor to be addressed to him at* 21, *Cockspur Street.*

CONTENTS.

PAGE.
ADVERTISEMENTS 1
APPLICATIONS FOR LETTERS PATENT 1
REVISION OF THE PARLIAMENTARY REPORT ON PATENTS 2
REVIEWS—
  Electric Force of Steam 4
  Natural History for Beginners 5
  The Naturalist on the Amazons 5
  Sea Industries 5
THE ECONOMY OF FUEL BY THE USE OF IMPROVED GAS APPARATUS FOR COOKING PURPOSES 6
PROCEEDINGS OF THE INVENTORS' INSTITUTE . 7
MONTHLY NOTICES 7
THE INVENTORS' INSTITUTE (CONTINUED) ... 8
SOUTHBY'S GAS COOKING APPARATUS (CONTINUED) 8
PROCEEDINGS OF SOCIETIES—
  Royal Society 9
  Society of Biblical Archæology 9
  Zoological Society of London 9
  Geographical Society 9
  Geological Society 9
  Chemical Society 9
  Meteorological Society 9
  The Institution of Civil Engineers 10
APPLICATIONS FOR LETTERS PATENT 10

THE INVENTORS' INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE.

Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organizing the influence of Inventors, Patentees and others. Its objects are:—

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2nd. To promote improvements in the Patent Laws.

3rd. To facilitate the diffusion of information with reference to Inventions and other subjects beneficial to Inventors and Patentees.

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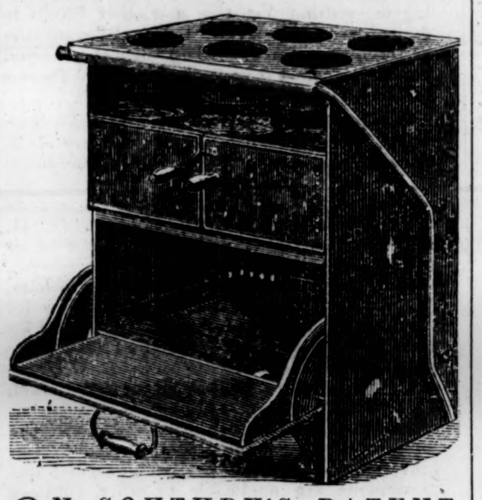

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APPLICATIONS FOR LETTERS PATENT.

⁂ In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross.

On September 23rd.—3107 to 3119.—W. W. Newport. Supporting window tickets and other tickets without the aid of any detached contrivance.—J. J. Lundy. Lubricating compound to be used as a substitute for oil or grease in the lubrication of machines or machinery.—L. Gold. Make or manufacture of trousers and similar articles of wearing apparel.—Rev. G. H. Forbes. Manufacture of compounds to be used as fuel.—J. W. Hatch. Heel stiffenings for boots and shoes.—C. R. Huxley. Means of obtaining motive power by the rise and fall of the tide.—J. H. Cooper, T. A. W. Clarke, A. R. Donisthorpe, and E. Corah. Knitting machines.—J. C. Graham. Obtaining fibre from rhea and such like plants, and machinery to be used for that purpose.—R. Fennelly. Suspended railways (com.)—R. Fennelly. Railway and tramway wheels, axles and axle-boxes (com.)—W. R. Lake. Preparation of peat for fuel and machinery therefor (com.)—B. Browne. Method of locking or securely holding screwed nuts on the screwed ends of bolts, rods, or pins used in mechanical and other structures, used also in the construction of various tools and implements.—C. Michel and A. Frager. Water meter or apparatus for measuring the flow of liquids.

On September 24th.—3120 to 3126.—W. E. Simonds and H. Dyer. Railway carriage wheels, the manufacture thereof, and moulds therefor (com.) (Complete specification.)—W. Whiston. Dyeing and printing silks and other woven fabrics.—J. Stubbs and J. Corrigan. Machinery for winding two or more yarns or threads of cotton and other fibrous materials on to bobbins or spools preparatory to doubling the same.—E. H. Leveaux. Mode of and apparatus for driving carriages on tramways and railways, and other roads.—H. Conradi. Combination of a call-bell with holders or receptacles for various articles.—E. Morewood and J. H. Rogers. Applying tin or other coating metal to metal sheets and other surfaces of metal.—E. Morewood and J. H. Rogers. Applying tin or other coating metal to metal sheets and other surfaces of metal.

On September 25th.—3127 to 3136.—A. F. Blott. Tap.—G. Dobson and J. McKnight. Cropping machine for cropping Kilmarnock and other knitted bonnets.—G. Mackay. Extracting and recovering the oils, resins, and colouring matters of manufactured or waste fabrics, or from the raw materials of cotton, linen, wool, silk, or other similar substances, and utilizing the same.—T. H. Casey and J. J. Liddon. Compasses.—H. Brady. Apparatus for warming rooms and for other heating purposes.—R. Sutcliffe. Apparatus for heating the feed water for steam boilers, and the means or method of and appliance for cleaning feed water heating apparatus.—J. H. Johnson. Railway switches and mechanism for operating the same (com.) (Complete specification.)—J. B. Payne and G. J. Ping. Machinery for the manufacture of lace and fishing and other nets.—W. F. Ford. Machine for nailing the heels of boots and shoes.—F. Weil and F. M. Lyte. Coating iron and steel with certain metals, with special application to covering or coppering iron ships with an adherent and protective coating of a less oxydable metal, and general coating large or small pieces of iron and steel, and particularly iron ships, with copper.

On September 26th.—3137 to 3151.—J. F. Chevalier. Liquid polish for cleansing and brightening, painted, varnished, glazed, and metallic surfaces.—J. Beale. Engine to be used for pumping gases, air, or fluids.—J. Liebert. Apparatus for treating acorns and beech nuts.—F. C. Hathaway. Purses, pocket books, portmonnaies, letter cases, and other similar cases and articles.—D. O. Sandheim. Brooches, pendants, and other ornamental dress fastenings and dress ornaments.—F. Wirth. Cold-producing engine (com.)—R. Stone. Preparing peat for the manufacture of fuel, and machinery and apparatus employed therefor.—J. Ascough. Brooms and brushes.—J. I. Sands. Apparatus for locomotion, applicable to carriages, cabs, carts, tramway cars, and other similar vehicles.—G. Davies. Fringing fabrics.—J. A. Turner. Waterproof fabrics.—S. Alley. Apparatus to be used in connection with bearings or parts of machinery requiring lubrication.—G. Ritchie. Portable summer-houses or marquees.—A. E. Holmes. Apparatus for retarding and stopping railway trains, termed "continuous break apparatus."—J. M. O. Tamin. Purification of sugar, molasses, and saccharine juices, and the regeneration of part of the substances employed, and also the preparation of manure from the residues thereof.

On September 27th.—3152 to 3160.—E. O. Woerteler.—Process of silvering mica for use in the construction of reflectors and reflecting shades (com.)—T. R. D. Bingham. Mode of covering up hatchways and other openings in ships and boats.—J. M. Stanley. Method of injecting and using pulverised or granulated fuel into fire-places for generating heat in boiler and other furnaces.—W. Stevens. Manufacture of heels for boots or shoes, and apparatus therefor.—J. Young. Preparation of esparto grass, straw, "diss," or other similar materials for the manufacture of paper.—W. W. Symington. Net machines.—J. E. Rogers, Method of working the valves of steam pumping and other engines.—H. Vaughan. Rim and dead locks.—H. Bezer. Passenger or fare registering apparatus for omnibuses or other conveyances.

On September 29th.—3161 to 3167.—T. Baldwin. Steam engines and apparatus for applying the motive power of elastic fluids.—J. Forbes and J. Hamilton. Rotary engine and pump to be driven by water or steam power.—C. Anderson. Means or motive power and apparatus for propelling railway carriages or tramway cars.—J. Adams. Wind engines or mills.—J. Robinson and J. Smith. Machinery for cutting bungs or shives for casks.—B. P. Stockman and J. Bennett. Lamps for railway carriages and other purposes.—A. M. Clark. Apparatus for taking the shape or profile of the head and other parts of the human frame, and for reproducing other curved or irregular lines (com.)

On September 30th.—3168 to 3180.—C. T. Liernur. Pneumatic drainage works for removing and utilizing fecal matter. (Complete specification.)—W. Whitthread. Disinfectant and oxydizing agent.—T. Unsworth. Stop motion winding doubling frames.—W. Boaz. Improved instrument or apparatus for stopping or closing tubes or pipes.—I. Riley. Links or shackles for connecting chain cables and other chains.—G. A. Everett. Pressure gauges.—T. Johnson. Apparatus for signalling on railways.—J. Fischer. Construction of meter for measuring water and other liquid bodies.—A. V. Newton. Preparation of colouring matters, and the application of the same to the dyeing, printing, and marking of textile and other fabrics (com.)—H. M. Newton. Machinery for folding or pleating paper (com.)—H. Bramhall. Knives and forks, and the adaptation of handles thereto.—J. Potts, jun. Crossings for railways and machinery or apparatus for working and locking railway points and crossings.—T. Silver. Air-rarefying lamp burner.

On October 1st.—3181 to 3189.—J. Gedge. Braces (com.)—T. O. Dawson and J. Dawson. Printing machinery.—A. G. Harrison. Apparatus for "laying" or "topping" twine or cord made from flax, hemp, or other fibrous materials.—G. Ermen and A. Ermen. Apparatus for polishing yarn and thread.—F. G Voight. Apparatus used in the production of gas from hydrocarbon liquids.—G. Burt. Lamps.—N. Thompson. Stopping bottles and other similar hollow articles.—N. Thompson. Means for connecting together fire hose, tubes, and other hollow articles.—H. Sprengel. Production of sulphuric acid.

On October 2nd.—3190 to 3202.—J. H. Johnson. Production of ozone, and the application of the same to various useful purposes (com.)—R. S. Dale and J. Dale. Evaporating and concentrating solutions of caustic soda, potash, and their salts, acid liquors occurring in the manufacture of oxalic acid and also gelatine.—A. J. Dobson. Lock-bolts.—S. Bligh. Fire-stove and grate.—F. Wirth. Method of manufacturing carbonic acid of any tension, and applying this acid in a compressed state to produce motive power, extinguish fires, and to other industrial and scientific purposes (com.)—J. Thomason. Propellor for propelling ships or other navigable vessels.—R. Long. Picture frames.—N. D. Sparali. Improvements in the construction of lines and form of vessels, and particularly of steam vessels.—J. Price and J. R. Wigham. Railway carriage and low roof sunlights.—J. Artridge, jun. Method of holding or securing Venetian and other blinds in desired position.—W. R. Lake. Buoyant life-preserving mattress (com.)—E. G. Brewer. Sewing machines (com.)—T. Sheenan. Process for steelifying iron.

On October 3rd.—3203 to 3212.—C. R. Western and J. Hamilton. Band-saw machines.—R. B. Starr. Apparatus to be applied to omnibuses, tram cars, or similar vehicles to register the number of passengers carried and the various fares paid during a journey.—Rev. G. H. Forbes. Compounds designed to be used as fuel or for the manufacture of lime, cement, plaster, and artificial stone.—F. Hickinbotham, W. Marshall and S. Adams. Fastenings for the doors of railway waggons or trucks used for transporting coal and minerals, and for other like purposes.—J. Wass. Velocipedes.—R. W. Johnson. Manufacture of artificial or block fuel. (com.)—A. T. Allcock. Method of effecting an instantaneous cut-off in steam engines by the action of the governor.—B. J. B. Mills. Improvements in power presses, parts of which improvements are applicable to other purposes (com.)—C. Williamson. Manufacture of bustle.—J. H. Johnson. Lamps for burning heavy oils (com.)

On October 4th.—3213 to 3230.—W. Smith. Indicating the movements of railway switches or points and signals, and the apparatus for recording such movements.—J. W. McCarter. Apparatus for condensing steam.—J. Cleminson. Railway or other carriages.—J. Rice. Vessel for beer or other liquid.—W. G. Snoulton. Life rafts.—T. Robinson and A. Lister. Shuttles.—J. Harrop. Taps or valves.—A. W. Mason. Apparatus for producing optical illusions.—N. Thompson. Means for connecting together fire hose, tubes, and other hollow articles.—G. Warsop. Machinery for cutting coal and other minerals.—J. Moss. Sewing machines and apparatus connected therewith.—J. West. Apparatus used in the manufacture of gas.—A. L. Normandy. Distilling machines.—C. Ritchie. Apparatus for utilizing heat for heating, cooking, ventilating, and lighting.—G. Haseltine. "Receivers" for breech-blocks of breech-loading fire-arms (com.) (Complete specification.)—S. Sudworth. Apparatus for recording time and the pressure of steam and other fluids, also the vacuum of steam-engines and the speed of motive power engines.—H. Hodkingson. Machinery for preparing cotton and other fibrous substances.

On October 6th.—3231 to 3244.—G. Hill. Apparatus for showing the amount of money taken in a given time.—Count. A. De Bylandt. Graphometrical instruments.—W. McDonnell and C. McDonnell. Mode of cleaning or purifying and sweetening butter "scrapings" and rancid or decayed butter.—S. S. Bromhead. Rivet screw or fastening.—J. Tompkins. Kettle for domestic use.—Jos. Hyde and J. Hyde. Manufacture of iron.—G. A. Wilson. Rotary web printing machines.—T. Greenwood. Apparatus for grinding, pulverizing, or reducing mortar, loam, ores, or other mineral substances.—D. Hutton. Dredging machines.—A. M. Clark. Regulator for gas and other fluids (com.)—T. Elsley. Apparatus for opening and closing casements.—T. Hydes and J. E. Bennett. Apparatus for heating the feed-water of steam boilers.—E. O. Blake. Apparatus for carburetting and supplying carbureted air for lighting and heating purposes (com.)—B. Mallam. Carriage door handles.

On October 7th.—3245 to 3255.—E. S. Eyland and J. Warren. Mechanical arrangement applicable to pianofortes and music stands, for turning over the leaves of music.—H. Hahn. Metallic alloys (com.)—G. G. De L. Byron. Treatment and compounding of cast iron with other metals or materials containing such metals while in a molten state (com.)—W. Stephenson and R. Dunlop. Tools for cutting stone, freestone, and other minerals.—J. R. Ord and H. Maddison. Machinery or apparatus used for breaking stone.—W. R. Holyoake. Manufacture and means of exhibiting transparent devices or designs.—J. T. Martin. Manufacture of corks, and apparatus employed therefor.—E. Vosin. Cupola furnaces.—H. Deacon. Apparatus for the manufacture of chlorine.—T. B. Callard. Machinery for cutting caromel and such like substances.—C. Wood. Manufacture of mortar, cement, and concrete for building purposes.

On October 8th.—3256 to 3265.—T. Hyatt. Treating and working asbestos, and the application of the same to various useful purposes.—H. J. Griswold. Knitting machinery.—G. Haseltine. Steam lubricators (com.) Complete specification.)—R. Holden. Looms for weaving.—H. Atkinson and R. White. Method of opening and removing window and other sliding sashes.—G. Lowry and J. H. Gibson. Machinery for heckling flax and other fibres.—W. Fisken. Steam cultivating apparatus.—J. Petrie. Steam engines.—H. Gardner. Treating air for the production of hydrocarbon gas and apparatus or appliances therefor (com.)—T. Nott. Means of and appliances for securing handles or knobs, wheels, discs, and other articles upon spindles and shafts.

On October 9th.—3266 to 3280.—E. Cooke. Pipes for smoking tobacco.—S. Tuddenham. Construction of "common road carriages," partly applicable to railway rolling stock.—S. L. Delalot. Manufacture of iron and steel.—D. Blacker. Means or method of and apparatus for condensing and for attracting and absorbing the noxious gases arising from the combustion of coal gas used in connection with blast furnaces.—R. Williamson and J. Dale. Apparatus for collecting, moving, elevating, and lowering salt and other granular substances.—J. Holding. Nose bags and other appliances employed in the feeding of horses, sheep, and other cattle.—E. Pace. Machinery or apparatus for cutting splints.—G. Haseltine. Manufacture of gunpowder (com.) (Complete specification).—J. B. Howell. Punches (com.)—J. H. Johnson. Treatment of asphalte and the application of the same to pavements and other useful purposes (com.)—J. E. Walker and J. W. Cole. Apparatus for screening and picking coals.—H. T. Davis. Safety-apparatus for hoists, lifts, cranes, and other similar machinery.—J. Howden. Steamers for towing purposes.—J. W. Hunter. Apparatus or means for heating water for domestic purposes.—R. P. Williams. Permanent way of railway.

On October 10th.—3281 to 3297.—H. Finlay, M.D. Ascertaining and correcting the deviation of ships' compasses.—E. Clayton. Fermenting dough.—R. B. Richardson. Construction of doors for puddling furnaces.—H. Geering. Safes and strong rooms.—F. Wirth. Washing yarns, and the apparatus employed therefor (com.)—C. Davidson and C. D. Williams. Signalling apparatus for railways, part or parts of which shut off the steam from the engine and operate steam brakes.—R. Hutchinson. Treating oils and fats.—E. E. J. Sell. Apparatus for taking photographs at night.—J. F. W. Featherstonhaugh.—Treating the fatty and oily matters of animals and fish, for the production therefrom of lard, tallow, fat, and oil, and means and ap-

(*Continued on Page* 10.)

Scientific and Literary Review,

AND RECORD OF PROGRESS IN
ARTS, INDUSTRY, AND MANUFACTURES,
INCORPORATING THE
JOURNAL OF THE INVENTORS' INSTITUTE.

JANUARY 1, 1874.

REVISION OF THE PARLIAMENTARY REPORT ON PATENTS.

As all men of science and intelligence wish to begin a new year with the hope of improving upon the doings of the last, we think it right to present our readers with what appears to us to be something likely to aid Patent Law Reform, namely, the propositions agreed to by the Sub-Committee of the Inventors' Institute, appointed to consider the Report of the Select Committee of the House of Commons on Letters Patent, which we published *in extenso* in our number of 1st February, 1873.

The Sub-Committee of the Institute (hereinafter termed I. I. Com.) consisted of Captn. J. H. Selwyn, R.N., Messrs. Hume-Williams, F. H. Varley, F. W. Campin, A. J. Murray, C. G. Carttar, and the *ex officios*; it held several meetings, at which the following conclusions as to the statements and recommendations of the House of Commons Committee (hereafter referred to as H. C. C. Rep.), were arrived at, viz. :—

To paragraphs 1 and 2, H. C. C. Rep.—No objection.

Paragraph 3, *H. C. C. Rep.*—The *I. I.* committee, entirely dissenting from the conclusions contained in the first sentence, state—that Manufactures depend upon Inventions, not inventions on manufactures. Invention would certainly be more rapid under a well-devised Patent Law, and it is doubtful whether the present law affords either "stimulus" or protection sufficient to encourage the development of the great majority of useful inventions.

Paragraph 4, *H. C. C. Rep.* (which refers to the undesirability of substituting pecuniary rewards for patents).—The *I. I. Com.* not only recognised the truth of this conclusion, but desired to record their unqualified condemnation of the system of public pecuniary rewards, as being unpractical, impolitic, and sure to lead to grave injustice; and *added*—The true reward fairly earned is a per centage on the benefit derived by the community from the invention; however there may be, in the absence of such gain so made, in rare instances, a fair claim on the public purse.

On paragraph 5, *H. C. C. Rep.* (which condemns the defective state of the existing Patent Law), the *I. I. Com.* state—The committee emphatically confirm this conclusion, which they gratefully recognise as an instalment of the justice due to the public, to manufacturers, and to inventors.

Paragraph 6, *H. C. Rep.*, the *I. I. Com.* accepted only so far as it relates to protection being granted for a limited period, and to date back to the time at which it is applied for, but held that novelty of invention is a fact that can never be decided conclusively by any authority whatever. They also considered that a large number of valuable inventions would be lost to the public were the strict definition of the word "manufacture" to become an absolute limiting condition.

Paragraph 7, *H. C. C. Rep.* (proposing changes in provisional specification) *I. I. Com.* state—It is the opinion of the Committee that no change in the existing practice is necessary; the distinction between "provisional" and "complete" specifications ought to be preserved. No provisional specification should be open to inspection.

On paragraph 8, *H. C. C. Rep.*, as to all patented articles being manufactured in the United Kingdom, so as to supply the demand on reasonable terms. The *I. I. Com.* regarded this as entirely unpractical, many inventions being best carried into effect in other countries where cheaper labour or materials exist. All inventions by their very nature must conflict more or less with existing interests. No definition of "reasonable terms' has ever been attempted.

On paragraph 9, *H. C. C. Rep.* (which relates to the abolition of Patents for foreign inventions, except to the inventor or his representative) the *I. I. Com.* state—The introducer of a novel manufacture has, in many cases, been as great a benefactor to the public as the inventor, and in the public interest he should continue to be encouraged. And added—We prefer that the law should remain as it does at present, provided care be taken that the rights of the original inventor shall always be paramount.

On paragraph 10, *H. C. C. Rep.*, *I. I. Com.* state—If any Government dues are considered to be justifiable, which we dispute, we think it will be desirable to apply such dues in the manner which appears to be suggested in this paragraph, and that the Stamp Duties and official fees should be subject to a large reduction, say, at least one half of the present rates.

Paragraph 11, *H. C. C. Rep.*, was agreed to.

Paragraph 12, *I. I. Com.* quite agree that a special tribunal should be constituted for Patent matters; but consider that a well-constituted Arbitration Court would be preferable.

On paragraphs 13, 14, 15, *H. C. C. Rep.*, the *I. I. Com.* remark—We agree with the condemnation of the constitution and practical working of the Patent Commission contained in these paragraphs' and we consider that a more efficient and suitable authority ought to be substituted.

On paragraph 16 (*a*) *H. C. C. Rep.*, the *I. I. Com.* state—Though we are not averse to such a limited form of preliminary examination as is embodied in the Reports and Inventions-Right Bill of the Inventors' Institute, we aver that the defects mentioned in this paragraph (*a* section) work little, if any, practical public injury. Paragraph 16 (*b*). We dispute the fact that there is any such obstruction as would justify legislative interference. Paragraph 16 (*c*). We agree that an intending patentee has very insufficient means placed at his command for ascertaining whether his invention is new. Paragraph 16 (*d*). We emphatically affirm this remark of the Committee. This remark is to the effect that time, trouble, and expense of Patent proceedings are excessive.

The other propositions of the I. I. Com. we must reserve for our next number, but we may now state that a New Patent Committee of the Inventors' Institute has agreed that measures ought to be at once taken to get the cost of Patents reduced to at least one-half of their present prices.

Reviews.

ELECTRIC FORCE OF STEAM.

A Letter to the Secretary of the Smithsonian Institution, Washington, on Electricity as the Expansive Force of Steam, and soliciting an Experimental Investigation of the Theory, and also of an Allied Theory submitted for consideration at the Meetings of the British Association 1840 and 1848, and in various publications. By G. A. Rowell, Honorary Member of the Ashmolean Society, &c. Printed for private distribution by the Author, 3, Alfred Street, St. Giles's, Oxford, England. 1873.

Here is a production worthy of the attention of all natural philosophers. By this letter Mr. Rowell makes the following brief statement as to his theory :—

The theory on which the whole is grounded, is, that, as electricity has no weight, occupies space, and coats the surface of all bodies, there must be a point at which any substance (be its specific gravity what it may), if sufficiently minute, would be buoyant in the air if fully enveloped in its normal coating of electricity; that when expanded by heat, the increase of the surface of particles of water giving them a greater capacity for electricity, they are buoyed up into the air by their coating of electricity; that if condensed near the earth's surface, the extra quantity of electricity is withdrawn, and the vapour falls or is attracted to the condensing body and forms dew, &c.; but if it rises out of the electric attraction of the earth, and is then condensed, the electricity being insulated, forms an atmosphere around each particle of vapour, which surcharge of electricity not only suspends the vapour by its lightness, but also repels the neighbouring particles of vapour, and prevents the formation of rain; but on the escape of this surcharge of electricity from the particles of vapour, either from passing over high hills, from the air becoming damp and in a conducting condition, or from any other cause, the particles lose their buoyancy and fall as rain.

On the two following subjects the theory has been supported, or in a measure proved, by observations in America,—the theory on the cause of auroræ, advanced by Professor Loomis from phenomena during the great display in 1859, being almost identical with that proposed by myself in 1839 on theory alone; the only difference being that Professor Loomis gives from forty-five to five hundred miles as the limits of the aurora above the surface of the earth; whereas I hold that it is possible auroræ are seldom much above the level of the higher clouds, and often at a lower altitude; and I have shown that the observations of Dalton (*Trans. of the Roy. Soc.*, 1828)—which are so much referred to as proving the aurora to have been over one hundred miles above the earth—only prove that no reliance can be placed on observed altitudes of auroræ, and that each person sees his own aurora, as each sees his own rainbow. The theory, as applied to storms is, that "they generally result from a rarefaction of the air produced by the escape of electricity of vapour, during excessive rain from clouds at a low level; as water, when in a state of vapour in the atmosphere, must occupy the space of an equal weight of air; and as water is eight hundred and sixty times heavier than the air at the sea level, the fall of an inch of rain must produce such a rarefaction in the atmosphere over the whole space of the rainfall, as would result from the abstraction of the air over that space up to seventy feet in height during the time in which the inch of rain falls." This theory is strongly supported by facts brought out since the publication of the American weather maps; as it is at least proved that excessive rains are the cause of storms.

From the first advance of the theory I saw no necessity to deviate from the simple hypothesis (already given) which forms the basis of all that I have advanced, till in 1871, from a calculation suggested by myself, I found that the increase of capacity for electricity from any probable expansion of the particles of water at natural temperatures, would not alone be sufficient to produce the effects I attribute to that cause; yet I hold that the various phenomena referred to in my papers, can only be accounted for in accordance with the theory, that evaporation and the suspension of water in the air result from the particles of water being buoyed up into the air by their coatings of electricity; and I submit, that it is not only possible, but highly probable, that the normal electric coating of all bodies upon the earth is in proportion with their temperature.

With this slight change, or addition, I believe the theory will hold good on every point; as, in accordance with it, a particle of water in its most condensed state, when detached from every other particle, might be sufficiently buoyant from its natural coating of electricity to be carried away by any slight current of air; and particles with an increase of temperature, and consequently of electricity, would raise into the air from their increased buoyancy, where from loss of heat they would become surcharged but still supported by their electricity till the escape of the excess of it.

Thus, then, the theory remains the same as when first advanced, more than thirty years ago, except that instead of attributing the ascent of vapour to electricity resulting from an expansion of the surface of the particle, I now assume that it may be from its attraction for electricity by its increase in temperature; and the theory, that the distribution of electricity is thus affected by temperatures, is, I believe, fairly supported by thermo-electric phenomena.

With this modification, the theory will more readily apply to the cause of the long suspension of volcanic dust in the atmosphere, and the ascent of smoke to considerable heights in the air, from the minute particles becoming surcharged with electricity by their heated condition when they rise from the earth. And, although foreign to the subject treated of in the papers, I would suggest that the fact that extremely heated molten metal can be handled with impunity, may be accounted for from the powerful attraction of the intensely heated metal for electricity; which, coating the surface, prevents actual contact with it, and opposes a kind of non-conducting medium to the heat.

The expansive force of steam may also be accounted for in accordance with this theory, and to this subject I would more especially direct attention. This force is generally attributed to an enormous expansion or some undefined change in the particles of water; but we have no proof that the particles of water can be expanded in any great degree, or that water undergoes any real change beyond the separation of its particles when converted into steam; as even from high-pressure steam the water can be instantaneously reduced to its normal condition by condensation. Scientifically, steam is attributed to the expansive force of caloric; but this is hypothetical, and opposed to the fact that super-heated steam does not scald. I believe the expansion of steam arises from the intense force with which electricity is impelled to, coats, and thus separates the super-heated particles from the heated water. The agency of heat in the generation of steam is not a proof that it is the expanding force, and the connection of electricity with evaporation is obvious. During evaporation electricity is carried off, or, as I believe, is the great agent in producing it. The isolation of water retards evaporation. Applied electricity promotes evaporation. And on the condensation of super-heated steam electricity is enormously produced, as shown from its development by the hydro-electric machine. The fact that the temperature which will boil water (*i.e.*, convert it into steam) depends on the atmospheric pressure, shows that boiling does not arise from any change in the water on its acquiring a certain degree of heat, but may be caused by its temperature reaching that degree at which the pressure of the atmosphere can be overcome, and the most heated particles separated from the mass of water, by the force with which electricity is impelled to the surface of all bodies according to their temperature; when obtaining their full coating of electricity, the particles rise through the superincumbent water as steam. The ordinary boiling point at any one place, varies more than four degrees according to the atmospheric pressure; and on the summit of Mont Blanc the boiling point is 34° (*Fahr.*) below that of the sea level.—Water requires a higher temperature to boil in a glass than in a metal vessel; showing that the boiling of water is affected by the conductive properties of the vessel containing it; and it is well known that water and electricity are produced on the condensation of vapour. Water under pressure can be heated to 400° of temperature or more; the expansive force of the vapour increasing in a like degree by the increasing attraction of the highly heated particles for electricity. The cool and dry condition of high-pressure steam, when it escapes from the boiler, may arise from the still heated particles of water being so completely enveloped in electricity. In vacuo water will boil, *i.e*, steam will be produced, at a temperature of 72°; this phenomenon is explicable in accordance with the theory now advanced, and is analogous to that of the rapid evaporation of water in vacuo, which I attribute to the particles being buoyed up, one upon another, by their natural electric coatings on the pressure of the air being taken off.

I submit, that on this theory the even temperature of boiling water is fairly explicable, as each particle, on acquiring the necessary degree of heat, would instantly obtain its proportionate coating of electricity and be carried off by it. The non-visibility of steam while under pressure may arise from its then being one body of electricity, the particles of water being few in comparison to the space occupied, and too minute to be visible. The diminution of sensible heat im high-pressure steam on its escape from the boiler, as the heat of the water from which it is generated is raised above that of its ordinary boiling point, I attribute to the super-heated particles of water being completely and densely enveloped in their coating of electricity, and thus kept from actual contact with the bodies on which they impinge. And as somewhat connected with this subject, the fact that a globule of water may lie for a considerable time on extremely hot metal, with but little or no evaporation from it, I attribute to its being brought into a thorough negative or minus condition by the superior attraction of the heated metal for electricity; and thus the particles are deprived of the coating of electricity which would carry them off as vapour.

I respectfully submit for consideration this theory on the cause of the electricity and expansive force of steam; and earnestly solicit that it may be experimentally tested. I do this with much confidence, bearing in mind the importance of the experiments and investigations carried out on an allied subject by the Committee of the Franklin Institute more than forty years ago, and understanding that the nature of the force of super-heated steam is now much under discussion and investigation in America. Then, if successful on this, I may hope for a trial of the experiments which have been leading subjects in my mind for half a century, and proposed in my first, and repeatedly alluded to in subsequent papers, *i.e.*, the raising of electric conductors to the clouds, by means of a balloon, which, I believe, in accordance with the theory advanced, would withdraw the surcharge of electricity from the vapour, and produce rain; and similar experiments in high northern latitudes might produce an aurora or be effective during the prevalence of one. Such experiments would be costly, and perhaps of no real value beyond giving an insight into the cause of phenomena of the nature of which we have no real knowledge; but, if of sufficient importance, there is no country in which such experiments could be so properly tried, as that in which Franklin, by somewhat similar means, proved the identity of lightning and electricity.

NATURAL HISTORY FOR BEGINNERS.

"Outlines of Natural History for Beginners," being Descriptions of a Progressive Series of Zoological Types. By H. Meyne Nicholson, M.D., DSc., &c., Professor. William Blackwood and Sons, Edinburgh and London.

The intention of this admirable little work essays to convey elementary knowledge of natural history in a form suitable to junior scholars.

It has recently been asserted (says Dr. Nicholson) that zoology is not a subject which can profitably be taught in schools. In this opinion the author finds himself entirely unable to concur; and the present work is an attempt to solve, upon a new basis, the problem how the facts of natural history can be imparted to the previously uninstructed beginner in such a manner that he may obtain some real knowledge of the subject, and not a mere parrot-like acquaintance with a greater or less number of technical names.

In this work, no other preliminary knowledge is assumed in the learner than some slight acquaintance with the chief functions of the animal body. Or, it is assumed that the teacher, in the absence of such preliminary knowledge, will explain to the learner the meaning of such terms as "breathing-organs," "circulatory system," or the like, and will point out in what the processes of respiration and circulation really consist.

Instead of reviewing the divisions of the animal kingdoms in a systematic manner, a series of common types has been chosen, representing the various classes of animals, and the leading peculiarities of these types have been described more or less fully. At the close of the description of each type, the characters which it possesses in common with the other members of its class are pointed out; and in a concluding chapter it is shown how the classes may be arranged under larger divisions or "sub-kingdoms."

Two or three classes, as being of very small importance, have been altogether omitted. For obvious reasons, also, the reproductive system and processes of the animals here described have been altogether ignored. For equally obvious reasons, the peculiarities which are connected with *internal* structures have been in many cases passed over in silence, or merely alluded to; whilst attention has been directed to the conspicuous characters which are afforded by external points of structure.

The animals selected as representatives of the various classes are, with few exceptions, common types; and any teacher may readily obtain all of them, or nearly allied forms, for class demonstration, so that all the more important points alluded to can be shown to the learner upon the specimens themselves.

The technical terms employed in the descriptions of the types are exceedingly few in number, and explanations of their meaning have been invariably inserted in the text, along with their derivation, thus rendering a separate glossary unnecessary.

With the exception of the forms here chosen as representatives of the classes of the Pteropoda and Brachiopoda, the author may be permitted to state that he has personally examined and dissected, either in the fresh state or as preserved in alcohol, all the types here selected for description; and that in the cases excepted he has a similar personal acquaintance with forms closely allied to the ones described, whilst the latter have been studied by him as regards their hard parts. Since most of the forms here selected are of common occurrence, and since the author is by profession a teacher of Natural History, he does not state this as being in the smallest degree a fact worthy of praise, or, indeed, of mention at all in an ordinary way, but simply as a guarantee that he is not merely retailing second-hand information. Most of the facts, therefore, recounted in the present work, though by no means original, have been verified by the personal examination of the author; and the descriptions have been drawn from actual specimens.

We shall perhaps best inform our readers as to the way in which Professor Nicholson has fulfilled the task he has undertaken by stating that amongst the list of illustrative wood cuts contained in the book, which are clearly described in the text, are:—Section of one of the arms of a star-fish (Uraster rubens), anatomy of a wheel-animalcule, the anterior sucker of the medicinal leech and one of the jaws, structure of the integumentary skeleton of the lobster, internal anatomy of the lobster, anatomy of an insect, the common whelk (*Buccinum undatum*) and the tongue of the whelk; skeleton of the common frog, skull of the rattlesnake, head of the rattlesnake dissected to show the poison-gland, the grey lag goose, head of the grey lag goose, foot of the domestic goose, skull of the sheep dog, and skeleton of the dog. We think Professor Nicholson has done good service to the cause of real education for the people, if regarded, as we maintain it should be, as a system of acquiring knowledge of things around us, rather than (though not wholly exclusive of) mere book lore or scholastic learning. And although the Professor has been so modest as to term his work a school book, we can safely say that it would profit many who have long left school to attentively peruse it for the sake of obtaining some general scientific acquaintance with the animal world around them.

THE NATURALIST ON THE AMAZONS.

"The Naturalist on the River Amazon." A Record of Adventures, Habits of Animals, Sketches of Brazilian and Indian Life, and Aspects of Nature under the Equator during eleven years of travel. By Henry Walter Bales, F.L.S. (Assistant - Secretary, Royal Geographical Society). Third Edition, with numerous illustrations. London: John Murray, Abemarle-street.

Now that the time for New Year's Gifts has arrived, the issue from the press of a new edition of this pleasant and valuable work is exceedingly opportune, for no book could be better fitted for presentation to any young person, and for the matter of that to any old one either. To those of our readers who may not have made acquaintance with the two former editions of this work, we may say that it is not a scientific account in a dry way of naturalistic objects brought under the observation of the author during his rambles. He fully describes his adventures, and gives graphic accounts of places he has visited and their inhabitants. Amongst these places are Pará, the Tocatins, and Cameta Caripi, and the Bay of Marajo. The Lower Amazons—Olydos, Manaos, Santarem, the Tapojos, Ega, on the Upper Amazons, and beyond it.

As a specimen of the contents of this book, we present the following:—

My assistant, Jose, in the last year of our residence at Ega "regatou" (ransomed, the euphemism in use for purchased) two Indian children, a boy and a girl, through a Japura trader. The boy was about twelve years of age, and of an unusually dark colour of skin; he had, in fact, the tint of a Cafuzo, the offspring of Indian and negro. It was thought he had belonged to some perfectly wild and houseless tribe similar to the Paraparts of the interior of South America. His face was of regular oval shape, but his glistening black eyes had a weary, distrustful expression, like that of a wild animal, and his hands and feet were small and delicately formed. Soon after his arrival, finding that none of the Indian boys and girls in the houses of our neighbours understood his language, he became sulky and reserved; not a word could be got from him until many weeks afterwards, when he suddenly broke out with complete phrases of Portuguese. He was ill of swollen liver and spleen, the result of intermittent fever, for a long time after coming into our hands. We found it difficult to cure him, owing to his almost invincible habit of eating earth, baked clay, pitch, wax, and other similar substances. Very many children on the upper part of the Amazons have this strange habit, not only Indians, but negroes and whites. It is not, therefore, peculiar to the famous Otomacs of the Orinocs described by Humboldt, or to Indians at all, and seems to originate in a morbid craving, the result of a meagre diet of fish, wild fruits, and mandioca meal. It appears this youth was very intelligent, and acquired considerable expertness in his master's art of goldsmith.

As to the naturalistic features of the work, we may state that it contains descriptions and illustrations of the Saura ant, climbing palm, Amplus bœna, Assai palm, bird-killing spiders, flat-topped mountains of Pará· Quará laver, Amazons sackbearing caterpillar, and many other interesting natural objects.

SEA INDUSTRIES.

The Harvest of the Sea, including Sketches of Fisheries and Fisherfolk. By James Bertram. Third edition, with Fifty Illustrations. London: John Murray, Albemarle-street.

The author, in the preface to this third edition, tells us that the work has been a great success as promotive of fishing economy, showing that it has not simply served the purposes of pleasing the eye by its illustrations, and the mind by the agreeable strain of its descriptive matter, but has really afforded good practical information as to the character, and suggestions for the advancement of, our great fishery industries.

In the present edition the matter is thoroughly revised, much that was contained in former editions being excised, as out of date, or otherwise unnecessary, and a considerable amount of new and interesting information introduced. Recent official statistics of the Scotch and Irish fisheries are included in this edition, and a new chapter on Aquariums and Fishery Exhibitions has been interposed, as well as new stories of fisher life.

We regret that want of space prevents our presenting our readers with some samples of the work. As regards the practical science of the subject nothing is, perhaps, so important as the statements with regard to artificial spawning and hatching. We heartily commend the present edition of this work to the attention of our readers.

We are unavoidably compelled to postpone till our next issue reviews of the following works:—

"An Easy Introduction to Chemistry." Edited by the Rev. A. Rigg, M.A. (Rivingtons.)

"Elderhort's Blowpipe Analysis." Edited by Messrs. Mason and Chandler. (T. Ellwood Zell.)

"Treatise on Practical Solid or Descriptive Geometry. By W. Timbrell Pierce. (London: Longmans, Green, and Co.)

"The Naturalist in Nicargua." By Thomas Belt, F.G.S. (London: John Murray.)
"Life of Mrs. Somerville." A pleasant story of the life of an agreeable woman of high scientific attainments.
"Watchwork." Review of a Treatise on Watchwork, Past and Present. By Rev. H. L. Nelthropp, M.A., F.S A. With illustrations. London: E and F. N. Spon, 48, Charing Cross; New York: 446, Broome Street. 1873.

THE ECONOMY OF FUEL BY THE USE OF IMPROVED GAS APPARATUS FOR COOKING PURPOSES.

By E. R. Southby, Esq., M.R.C.S.

The following is a report of the paper on this subject read at the meeting of the Inventors' Institute on the 27th November last, as stated in another column:—

Gentlemen,—In the following remarks, I shall confine my attention to the production and utilisation of comparatively low temperatures, as, for domestic purposes, only such are ordinarily required. I shall further restrict myself to the utilisation of gas for cooking purposes. I hoped to have also dealt with the subject of warming by gas, but pressure of other business has prevented my doing so. Cooking divides itself into three principal branches—boiling, roasting, and baking; which I will take in the order named. In boiling by gas, except in certain special cases, the greatest economy is secured by impinging a flame of considerable intensity, such as that from a Bunsen or other air burner, directly on the bottom of the vessel containing the water to be boiled, and when a supply of hot water or steam to cook substances placed in a separate vessel is required, this plan may be safely adopted. There are, however, the following serious objections to all varieties of air burners:—First, offensive smelling and noxious products are usually formed when the flame is caused to impinge on comparatively cool surfaces, owing to its temperature being reduced too low for perfect combustion. Secondly, the flame in all these burners, as at present constructed, is more or less liable to "drop," as it is called. That is to say, the gas ignites not at the burner proper, as it ought to do, but within the tube of the burner at the point where the gas issues from the gas pipe for mixture with air before reaching the burner. The consequence being, that acroline, soot, and other offensive products are formed in large quantities. This dropping always occurs in Bunsen burners when the flame is lowered below a certain point. Guage burners are not so liable to it when the guage is perfect and of the proper mesh, but they soon get out of order, when they are more objectionable than the Bunsen. This liability to dropping when the supply of gas is reduced greatly diminishes the economy, for if the burner is large enough to bring the water rapidly to the boil, it cannot be reduced low enough to only just maintain that temperature without causing it to drop. The following results of experiments made with various burners will serve to illustrate my meaning.

(Mr. Southby here gave the details of these experiments, and then proceeded.)

The air burners have, therefore, only the advantage in economy, in heating the water to the boiling point, with the serious disadvantage of the offensive smell they produce. On turning off the gas to the point required to just maintain ebulition, which is the point at which most cooking operations are carried on, all advantage in economy disappears, and the simple jet burner, with its absolute freedom from smell, does the work better, for it maintains at all times an even temperature over the whole bottom of the cooking vessel, and, if anything, with a smaller rate of consumption than the offensive air burner. What is still wanted is a simple apparatus to heat water to the boiling point, more economically than the air burner, and without its drawbacks, We think we have succeeded in accomplishing this, but I am not prepared this evening to enter into details further than to say we can raise one gallon to the boil with under 3½ ft. I may here mention, as a simple means of rapidly procuring a large supply of hot, or even boiling water, R. W. Maughan's "Geyser." (A model of which Mr. Southby here exhibited.) It consists of a burner composed of horizontal tubes with fine perforation, through which the gas burns without previous admixture of air (an air burner is quite inadmissible in this apparatus), a conical combustion chamber, with a hemispherical cap over its upper opening, with a space between the two for the heated air to ascend, a second cap so arranged as to direct the stream of water partly against the outside case and partly over the first cap. An outer case enclosed the whole, from the top of which springs a cylinder, acting as a chimney, and containing an arrangement of spiral wires over which the water to be heated flows in a thin film. Above this is the cold water reservoir, with a perforated bottom to distribute the water, and a jacket outside with a space between them to allow the escape of the products of combustion which have, by the time they arrive there, accomplished their purpose. The Geyser is certainly a very ingenious and useful apparatus. Heating, as one of the larger sizes does, a full-sized bath in ten minutes, and children's baths in a still shorter time, it may frequently even be the means of saving life in cases of sudden illness. For boiling water it is about equal to the air burners in economy, the larger sizes requiring 4 ft., and the smaller ones 5 ft. of gas per gallon of water, from 60° to 212°. For heating large quantities of water to 100° the economy in cooking is much greater, the gas required being only at the calculated rate of 3 ft. per gallon of water heated 152°, that is the number of degrees between 60° and 212°. Gas, however, can only under special circumstances compete in economy with solid fuel for boiling purposes, except where the quantity of water to be boiled is small. Extensive establishments should always have a well-arranged steam generating apparatus heated by coal or coke, to effect their larger boiling operations.

We have, as yet, chiefly considered the raising of water to the boiling point, but this constitutes but a very small part of even the boiling department of cookery. The large proportion of operations are on a very small scale, and where the cooking is only for six or seven persons, all the operations are small. In some of these, full ebulition is never required, and in most of the others, as soon as it is reached, the heat must be reduced so as only just to maintain that temperature. For all these the simple jet burner, as arranged in Southby's apparatus, is at least as economical as any other, and is the only one that can produce perfect results, as it is the only one that keeps the whole bottom surface of the cooking vessel at a uniform temperature, and at the same time a temperature that can be regulated without trouble, and with unfailing accuracy. With this burner, there is no burning of the substances, in process of cooking, to the bottom of the vessel, and even in preserving, usually one of the most troublesome operations, requiring unremitting watchfulness, but little attention is required. The reason for this is evident, instead of the heat being derived from absolute contact with flame as in other burners, it is only heated air and radiated heat that reach the surface of the cooking vessel. Air burners can of course be arranged to a certain extent to act in the same way, but directly the flame ceases to envelope the surface of the vessel, their only advantage vanishes, while their disadvantages in great part remain. Frying and cooking in heated fat can also be conducted most perfectly and economically over these burners, and by means of a reflecting cover the toasting of bread can be quickly and perfectly accomplished, about four minutes being sufficient.

I now come to roasting—the second great operation in cookery. To arrive at perfection in roasting, on the old system, is so difficult, that Soyer declared none but born roasters could accomplish it. The gas roaster has now made it one of the most simple, and certainly successful, processes that can be imagined. The economy of gas for roasting purposes over all other fuel is pre-eminent and indubitable, whether on the largest or the smallest scale, whether for roasting an ox or a delicate leg of Welsh mutton. The economy, indeed, is so evident that accurate experiments seem scarcely needed to prove it. You have only to look into a kitchen where even an eight or ten-pound joint is roasting before an open fire, to see the frightful waste of heat. In gas roasting, on the contrary, the heat can be economised more perfectly than in almost any other operation. Certain rules in the construction of the apparatus must, however, be strictly adhered to. In some of the oldest gas roasters, the meat was hung in a cylinder, forming a chimney to a number of jets burning at its base. This plan was, however, very faulty. The heated air was allowed to escape before it had done its work, and a great portion of it before it had even come in contact with the meat. The dripping also, in spite of numerous contrivances to prevent it, was always falling on the burners, choking them, and giving off torrents of offensive vapours. The results were an abominable smell, great waste of gas, and very imperfect roasting. Leoni's improvements were among the first that altered this state of things. In his patent apparatus there is no opening at the top, so that the heated air is kept in contact with the meat sufficiently long to enable it to do its work. The consumption of gas is thus considerably diminished, and more perfect and uniform results are secured. Another form of apparatus has been lately introduced, in which the meat is cooked by jets placed above instead of below it; but the consumption of gas is said to be very large, and the results uncertain. I now come to my brother's patent apparatus, now being manufactured by the Economic Gas Range and Roaster Company, by which we think a further great improvement in gas roasting has been effected. A short description, and the results of a few carefully-made experiments, will enable you to judge whether we are correct in our estimate of this invention. The roaster consists, as you see, of a chimney, open at the top and bottom, in which the gas is burnt in a strong current of air. The burner used is composed of No. 2 cannel fishtail jets tapped into a piece of iron tube; by using this very small sized jet the richest gas can be burnt without danger of its smoking. There is also a dripping pan with a gridiron resting on it, on which to place the meat, and a cover that rests on the dripping pan, leaving a space between the two for the escape of the vapours, and enclosing beneath it the upper portion of the chimney as well as the gridiron and whatever may be placed thereon. The result of this arrangement is that when the gas is lighted a powerful current of highly-heated air rushes through the chimney to the top of the cover, where, as there is no opening, it diffuses itself, and descending as it cools, ultimately passes out between the edge of the cover and the dripping pan. It is evident that on this plan, that portion of air coming in contact with the meat in process of roasting, will be most rapidly cooled, and will at once drop downwards and pass away under the edge of the cover, carrying with it the meat vapours, which, if retained at a high temperature in contact with it, give it that disagreeable and unwholesome flavour

(Continued on page 8.)

The Scientific and Literary Review

Is published at the
OFFICES, 21, COCKSPUR STREET, CHARING CROSS.
LONDON, S.W.,

On the 1st of every Month, and sent post free on prepayment of the Annual Subscription of 6s. 6d.; or it may be had, by order, from Messrs. KENT and CO., Paternoster Row, or any Bookseller or Newsagent in the kingdom, *price 6d. per copy.*

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Chairman of the Council: SIR ANTONIO BRADY.

NOTICES.—SESSION 1873-4.

Thursday, Jan. 8th, 1874.—Conference of Council and Members on "Patent Law Reform."

Thursday, Jan. 22nd.—On "Communication Apparatus for Railway Trains." By F. Rowe, Esq.

TO MEMBERS OF COUNCIL.

Council meetings to take place at 7 p.m. on same evenings.

Subscriptions are payable to Mr. G. A. Stretton, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. Campin, Sec.

Proceedings of the Institute.

At the second members' meeting, held at 4, St. Martin's-place, Trafalgar-square, on Thursday, Nov. 27, Mr. F. H. Varley, Chairman of the Ordinary Council, or Executive of the Institute, presided, when E. R. Southby, M.R.C.S., read a paper "On Economy of Fuel by Economic Gas Cooking Apparatus," which is given in another column.

After the paper had been read, the following discussion ensued:—

The **Chairman**, in inviting discussion, said that Mr. Southby's statements, as he understood them, proved that when the proper economic apparatus was used, gas as fuel was twelve times cheaper than coal. This was, he thought, a great stride when we considered the high price of coal, which was more likely to go up to 60s. per ton than to go down below its present price; and, further, that the improved economic apparatus just described reduced the cost of gas fuel to four times cheaper. To his mind, the great thing that makes the use of gas preferable to coal was that the waste which takes place in an open fire was avoided. For before you can, with any comfort, cook before an open fire, the time taken, after lighting, will be about twenty minutes, and during that time the heat is being wasted. Now, with gas cooking this is not the case, as the requisite heat for cooking you can obtain in a very few minutes after lighting, and gas therefore offers very great facilities for roasting and other purposes. But he would ask Mr. Southby whether the cyanogen produced by air burners, in any way, appears in his roaster.

Mr. **Bartlett** remarked that he had heard the paper that evening with great pleasure, and he was there to testify to the efficiency of Southby's apparatus in point of economy, for, having used many different gas cooking apparatuses, he could truly assert that Southby's was the best, and he had used it for a long time past. Air burners he had tried, but he found them objectionable, as they were liable to "drop." Leoni's he had also tried, and he had come to the conclusion that Mr. Southby's was the most economical form for use in cooking or roasting. He generally used the single

[Continued on Page 8.]

Monthly Notices.

Dr. Johann August Friedrich Breithaupt, one of the most distinguished mineralogists of Germany closed a long and useful life on the 22nd of last September. Born at Probstzella, near Saalfeld, in Saxe-Meiningen, he was educated at Jena and at Frieberg, in Saxony. With the Royal Saxony Mining Academy of Freiber Breithaupt's name has long been closely associated. His official connexion with the Academy commenced in 1813, and extended over more than half a century. On the death of Werner, in 1817, Briethaupt succeeded as Lecturer on Mineralogy, or rather on "Oryktognosie," as the science was then called. During his lifetime he published about 150 scientific memoirs, and several valuable works on mineralogy. "Die Paragensis der Mineralien" is, perhaps, the work by which Breithaupt is best known to the scientific world. No man ever equalled Prof. Breithaupt for acquaintance with the physical constitution of minerals.

Les Mondes for November 6th gives a full account of the new combustible of M. Pagliari, which, in these times of dear coal, may attract some attention. It consists of petroleum, resin, coal-dust, charcoal-dust, saw-dust, and sulphate of lime. It is stated that the calorific power of this combustible is more than double that of coal.

Plastic Carbon.—In the "Polytechnisches Notizblatt," Prof. V. Kletzinsky recommends a "plastic carbon" for filters, which is said to answer admirably. It is composed of coke, animal, and wood-charcoal, and pipe-clay. The ingredients are dried and reduced to powder, then mixed with molasses to a plastic state, baked in a muffle, soaked in dilute muriatic acid, washed, dried, and baked a second time.

Proposed Physical Society.—Meetings has been held in the Physical Laboratory of the Science Schools at South Kensington, to promote the formation of a Physical Society, the chair being taken by Dr. J. Hall Gladstone, F.R.S.

An International Scientific Series is now publishing by Messrs. H. S. King & Co., there will be a work on the "New Chemistry," by Professor Josiah P. Cooke, of the Harvard University. The same firm have in the press a work on the "Prolongation of Human Life," by Dr. John Gardner, the author of a well-known treatise on Domestic Medicine.

Waste of Power by Friction.—Prof. Fleeming Jenkin, in his inaugural address in the University of Edinburgh, on November 4th, described an experiment which he had been enabled to make in the cotton works of Messrs. Crosse and Winkworth. The connexions of 20,000 cotton-spindles were broken, and it was found that one-tenth only of the power produced was necessary to spin the thread; more than half is required to drive the machinery used; one-third is required to overcome the friction of the engine and the shafting alone. Less certainly than one-sixth, perhaps as little as one-tenth, of the whole power is required to prepare and spin the cotton. Here is a vast field open for the exercise of ingenuity.

Death of Professor Agassiz.—The *Daily Telegraph* thus records the death of this eminent natural philosopher:—Louis Agassiz, the distinguished professor of geology and comparative anatomy, who has just died in America, was a native of Orbe, in the canton of Vaud, Switzerland, where he was born in 1807. He was educated at Biel, Lausanne, Heidelberg, and Munich, giving from an early period proof of a strong bent for the study of natural science. At Munich he became associated with Martius and Spix, and published a descriptive work on a large number of new species of fish, which Spix had discovered in Brazil. This volume appeared in 1839, and for several years afterwards Agassiz devoted himself to ichthyology, embodying his views in large and important works that were published in France, England, and Germany. From the fresh-water fish of Central Europe, in the observation of which he was assisted by Carl Vogt, he proceeded to fossil ichthyology, while these researches, in their turn, led to his well-known investigation of the theory of glaciers. His views on this subject attracted much attention. Agassiz endeavoured to prove that the movements of glaciers and the transport of them by large boulders were accounted for by a somewhat sudden and general access of cold over the surface of the globe, a glacial epoch immediately preceding the existing period of the world's history. It was during his researches in Switzerland—Agassiz being then Professor of Natural History at Neufchatel—that he was visited by Prof. Forbes, who anticipated his friend by making public a theory of the viscous constitution of glaciers, which has recently found a defender in Mr. John Ruskin. The studies of Agassiz on this subject retained a charm for him up to the last—his latest inquiries being into the glacial remains on the Pacific coast of Central and South America. He had also examined minutely the Atlantic and Gulf coasts. Quite recently he superintended the American deep-sea explorations. Professor Aggasiz was a believer in the doctrine of successive creations of advancing organisms, and a strenuous opponent of Mr. Darwin's theory of evolution. In the course of the anthropological discussions of recent years, Agassiz has declared in favour of the original plurality of races of mankind. Few of the savants of the present day have observed and written so much, or enjoyed a wider reputation. He was elected a correspondent of the Institute so early as 1839, and was only a few years ago awarded the grand prize of the Academy. He had many friends in this country, and on several occasions has made use of British geological museums. Since 1846, when he accepted a professorship at Harvard College, his writings have been chiefly devoted to the natural history and geology of America, and they have in a great measure given the tone to the prevaling scientific opinion and research in the New World.

THE INVENTORS' INSTITUTE.

[CONTINUED FROM PAGE 7.]

cover, and, in fact, preferred it to the double cover. He had found that a small joint of meat could be cooked at the expense of about eight or nine feet of gas per hour. Another great advantage he had found consisted in the fact that a person who had never before practised cooking could, with the greatest ease, cook a joint, of course with the slight expenditure of common-sense. Of this he had practical experience. The products from this roaster he had found were of the purest description, and of the efficiency of the invention he had no doubt.

Mr. **MACOMBER** asked Mr. Southby whether a steak could be done by his arrangement, and Mr. Southby said that his arrangement admitted of it being done, and that indeed very well; and in this he was confirmed by Mr. Bartlett, who thought that a steak cooked in this roaster was of quality superior to those done before an open fire, and that the time taken to cook it was about a quarter of an hour. In fact, anything could be cooked well except chops, which he could not say he preferred to be cooked in this range any more than any other gas apparatus. Even water-fowl he preferred cooked by Mr. Southby's method.

Mr. **SOUTHBY**, in answer to a question, said that he preferred the arrangement as now constructed, that is, with a double cover.

Mr. **TOOTH** having made some remarks in favour of the invention,

Mr. **BARLETT** said he would claim the indulgence of the meeting to allow him, as a chemist, to state his opinion that cyanogen was not produced in Southby's apparatus, though here and there a trace could be tasted. In this apparatus a larger body of air must impinge upon the meat, and the objectionable products—that is, the meat fumes which pass away under the cover—do not come in contact with the meat.

Mr. **SOUTHBY** said the meat in all cases is absolutely covered, and it is always found that the products of steam is being given off.

Mr. **CAMPIN** said that there was a prejudice in people's minds against gas cooking, but for several years past one of the common gas cooking stoves had been used in his house, where they had never found any objection except that the fatty matters were liable to drop upon and choke up the gas jets; moreover, the common apparatus was not cheap as to cost of fuel.

Mr. **MAUGHAN** said that his experience was decidedly in favour of cooking by gas. He partook some forty years ago of a joint cooked by gas, and he had never since partaken of a joint so well done as that was.

The **CHAIRMAN** said that what struck him most was the marvellous simplicity and ingenuity of the invention, which left nothing to be desired. He supposed he must call on Mr. Southby to reply, but he thought that the questions that had been raised were answered. The only question he thought might be considered left open was the cooking of a chop, which, he admitted, generally speaking, was the one weak point in his, and all, gas cooking arrangements, but he thought that you could not expect a gas apparatus to do that, for cooking a chop was the most severe test that could be applied.

Mr. **MACOMBER**, in proposing a vote of thanks to the reader of the paper, said the question with regard to cooking a steak had been answered to his entire satisfaction. He did not enter into the question of a chop; that was not his intention, because he preferred a steak. He begged to propose a vote of thanks to the reader of the evening for his able paper, and he would also take occasion to remark that the meeting was greatly indebted to Mr. Bartlett for giving the results of his experience.

The **CHAIRMAN** said that Mr. Macomber had anticipated him in moving the vote which was put and carried unanimously.

Mr **SOUTHBY** briefly returned thanks, when the **SECRETARY** (Mr. Campin) proposed, and Mr. **MORGAN** seconded, a vote of thanks to the Chairman of the evening, which was put and carried unanimously.

The **SECRETARY** then announced that on Dec. 11th, the paper to be read would be "On Automatic Railway Couplings," by W. Gadd, Esq , C.E., and the meeting dissolved.

At the Council meeting (ordinary), preceding the above members' meeting, Mr. F. H. **VARLEY** in the chair, after the confirmation of the minutes of the last meeting, a resolution was passed appointing a committee—consisting of Messrs. F. H. Varley, H. Williams, D. J. McLauchlan, C. G. Carttar, A. J. Murray, F. W. Campin (the Secretary), and the other *ex officios*—to take immediate action for progressing Patent Law Reform.

At the third members' meeting on Dec. 11th, Mr. W. **GADD**, C E., read the paper announced to be read at the meeting on Nov. 27th.

The council (ordinary), as usual, met before this meeting, confirmed the appointment of the committee for progressing Patent Reform, and transacted formal business.

The report of the members' meeting we are compelled to postpone.

The following gentlemen have been placed on the list of members:—J. Beale, P. H. Williams, W. H. Silcock, J. McSkimming, Marshall, Adams, Penrose, M. Fenton, O. C. D. Ross, Capt. T. R. D. Bingham, H. W. Pendred, C.E., J. Fielding, J. Ellis.

SOUTHBY'S GAS COOKING APPARATUS.

(Continued from Page 6.)

by which everyone recognises ordinary oven cooking. To prevent this taste of the oven, it is the meat rather than the oven that requires to be ventilated, that is to say, it is necessary to cause a rapid current of heated air to pass immediately in contact with the surface of the meat. Now, in the old form of gas roaster, as the heated air could pass out at the top of the apparatus, it would, of course, take the shortest, most direct, and least obstructed course, avoiding the meat, and rushing up through any clear spaces. The result was not only a heavy loss of heat, but, as no current of air passed over a great portion of the surface of the meat, imperfect ventilation and unpleasant flavour. In Leoni's apparatus the heated air cannot pass away without doing its work; gas is saved, and a certain amount of ventilation secured; but, as there is no brattice between the upcast and downcast currents, the results are still far from perfect. In Southby's economic apparatus, the chimney forms a perfect brattice, and the laws of nature are allowed full play. The heated air can freely rush to the top, and as, in accomplishing its work, it loses its heat, and becomes saturated with the meat vapours it is so essential to get rid of, its constantly increasing density causes it to fall until it passes freely away at the bottom. In gas roasting, air burners of all varieties are objectionable, and as, in this case, they have no possible advantage, even in economy, over the simple jets they should never be used. With the simple jets burning in a chimney, it is impossible that any unpleasant flavour or taint can ever be communicated to the meat, but if air burners are used the flame may drop and spoil the roast. I must here say a few words in answer to an objection raised against roasting meat in contact with the products of the combustion of gas. Three conclusive answers can be given to this objection. The first is that what we are content to take in large quantities diluted over our palates (and through our noses) into our lungs will surely not injure a roasting joint of meat by coming in contact with its surface. We use the same jets and the same gas for roasting that we light our rooms with, and the products must in both cases be the same. The second answer is that coal gas being derived from coal simply by distillation, can contain no elements that coal does not contain, and the products of combustion as long as it is perfect, must be the same, with this exception, that as the sulphur which exists in coal has been almost entirely removed from the gas, there are mere traces of sulphurous acid, produced instead of the large quantities yielded by coal. Everybody will, I think, agree with me that no meat can be more free from taint than a chop or steak broiled on the top of a bright open fire, and yet it is certainly cooked in the products of combustion in their most concentrated form. The third answer is that gas, when perfectly burnt in air, produces only carbonic acid and water, the exact compounds you have in a bottle of soda water; yet who would think of objecting to the vapour of such a remarkably innocent body coming in contact with the roasting joint. I am of course always speaking of perfect combustion, and it is because the combustion in air burners is liable to be by no means perfect, that I totally object to their use in gas roasting. I believe to their use may be traced the greater portion of the prejudice existing in many people's minds against gas cooking. I will now give the results of two experiments with our No. 1 roasters to demonstrate their economy. The first was on a sirloin of beef, weighing six pounds twelve ounces raw. It was cooked in the ordinary No. 1 roaster, with a plain sheet-iron cover. The time taken in roasting, from lighting the gas, was one hour fifty-five minutes, and the gas consumed 7½ feet, being at the rate of 3¾ feet per hour. It was rather underdone, and for those who prefer meat without a shade of red down to the bone, should have been left in thirty-five minutes longer, during which time 2¼ feet more would have been consumed; so that we may say a joint of about seven pounds in the No. 1 roaster, if required underdone, takes two hours and 8 feet of gas; if required very well done, it takes 2½ hours and 10 feet of gas. The present value of 10 feet of common gas in London is one halfpenny. This sirloin of beef weighed, when roasted, five pounds fifteen ounces, and the dripping from it eight ounces, making the loss only five ounces. The second experiment was made with a No. 1 roaster with this form of cover; it is exactly like the other, but with an outer casing of tin, leaving a space between the iron and tin of about one inch at the crown, running away to nothing at the edge, where the tin is closed tightly over the iron. This outer tin case or jacket, with the layer of still air enclosed between it and the iron, prevents a large amount of radiation. In this case, a leg of Welsh mutton, weighing five pounds raw, was roasted in two hours and ten minutes, with rather under $5\frac{3}{4}$ feet of gas, being at the rate of just over $2\frac{1}{2}$ feet per hour, that is to say, the gas consumed by one very small burner. The leg of mutton was very well done, in fact, too much done to suit the taste of many people, and that with one farthing's worth of gas. The leg weighed, when raw, five pounds, when roasted, four pounds, besides which, there was $4\frac{1}{2}$ ounces of gravy, and $3\frac{1}{2}$ ounces of dripping, making the loss eight ounces. I wish to draw your particular attention to the rate of consumption per hour, as that governs everything. In these roasters any sized joint can be cooked that you can get under the cover, and in all cases the rate of consumption per hour will be the same, only the larger the joint the longer time it will require. Now, the rate for the No. 1 roaster with single sheet-iron cover is four feet per hour, the largest sized joint you can get into it seven pounds, and the time required for such a joint $2\frac{1}{2}$ hours, total gas required, ten feet. The rate for the No. 1 roaster with double cover, sheet-iron inside and tin outside, is $2\frac{1}{2}$ feet per hour, and in the same way with a seven pound joint taking $2\frac{1}{2}$ hours, the total gas required is $6\frac{1}{4}$ feet, costing only a small fraction over one farthing! This will, I think, be allowed by all to be a triumph of economic roasting.

I will now consider briefly the third operation, baking, and more especially pastry baking, for as few families bake their own bread in towns where gas can be obtained, baking bread by gas is of little importance. Our roasters, whether in the separate form or combined in a range, will, however, bake bread very satisfactorily. For baking pastry, gas roasters are superior to any form of oven, both in economy, ease of working, and perfection of results. What is essential for this purpose, is a temperature that can be regulated to the greatest nicity and maintained perfectly uniform as long as it is required. This can only be secured by the use of gas. Even the best arranged ovens heated in the ordinary way are constantly varying in temperature, burning the pastry at one minute, and not cooking it with sufficient rapidity to prevent it becoming sodden at another; besides the expense and labour of getting up the heat to a sufficiently high point to begin with. With Southby's gas roaster, on the other hand, the temperature is raised to the exact point required in two or three minutes, and can be maintained at exactly the same point for any length of time. For baking, as for roasting, the economic gas roaster secures perfect results with the greatest economy in both fuel and labour. For ordinary family use, the gas range, especially if combined with a good water heating apparatus also worked by gas, is an enormous economy over the ordinary kitchen fire, whether in an open or close range. For at least eight months out of the twelve, no kitchen fire need be lighted at all, and when a small fire becomes necessary for warmth, it can be utilized for boiling, and only the roasting portion of the gas range kept in operation; or the range may be put on one side, and a gas roaster substituted. In these days, too, when good domestic servants are becoming daily more difficult to find, the advantage of having an apparatus by means of which the most inexperienced can cook a dinner respectably, and that without annoyance from dirt or heat, is certainly very great. For these reasons, I have faith in the rapid extension of cooking by gas; and, effecting as it does a very great saving in the consumption of coal, I think I may say that its adoption to the greatest possible extent is a subject of national importance.

Proceedings of Societies.

ROYAL SOCIETY.

NOVEMBER 20TH.—The President in the chair.—The following papers were read:—"Note on the Electrical Phenomena which accompany Irritation of the Leaf of *Dionæa muscipula*," by Dr. Sanderson; "On the Algebraical Analogues of Logical Relations," by Mr. A. J. Ellis.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

DECEMBER 2ND, 1873.—Dr. Birch, K.R., F.S.A, F.R.S.L., President, in the chair.—The following papers were read:—1. "Future Punishment of the Wicked, a Doctrine of the Assyrian Religion." By H. Fox Talbot, Esq., F.R.S. In this sequel to the learned author's former papers, he tried to prove from his Legend of the Descent of Ishtar to Hades, especially lines 32-6, "of the lighting up of consuming flames to envelop the abusers of the conjugal tie," that torments for the wicked in the world after life must have been doctrinally taught in the Assyrian religion, which portion he illustrated by many grammatical and archælogical notes. 2. "Notes from Borneo, illustrative of Passages in Genesis." By A. M. Cameron, Esq. In this paper the author cited a Dyak tradition, that at an archaic general inundation, the ancestors of the Chinese, Malay, and Dyak had to swim for their lives; and (possibly foisted on this tradition) the Dyak preserved his weapons, and the Chinaman his books. A second tradition stated that an ancestral Dyak made a ladder to go up to heaven, unhappily one night a worm ate into the foot of the ladder and brought all down. Mr. Cameron further stated that one of the two Dyak names for the Supreme Being is Youvah; the author refers to the similar sounding Jehovah and Yahveh of the Bible. Seven new members were elected.

ZOOLOGICAL SOCIETY OF LONDON.

DECEMBER 2ND, 1873.—Dr. A. Gunther, F.R.S., Vice-President in the chair. The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of October and November, and called particular attention to two Sand Badgers (*Meles ankuma*) from Japan, presented by Lieut. the Hon. A. C. Littletòn. The Secretary exhibited and made remarks on a fine head of *Alcelaphus tora*, which Mr. Edwin Ward had sent for exhibition. This animal had been obtained by Mr. C. L. Arkwright on the Settite in Upper Nubia. Mr. J. W. Clark exhibited and made remarks on the remains of a Martin Cat from the Fens of Cambridgeshire. A communication was read from Dr. James Hector, C.M.Z.S., containing an account of the complete skeleton of *Cnemiornis calcitrans*, Owen, and showing its affinity to the Natatores. Professor Owen, F.R.S., read a paper containing a Restoration of the Skeleton of *Cnemiornis calcitrans*, Ow., with remarks on its affinities to the Lamellirostral group, and forming the twentieth part of his series of Memoirs on the Extinct Birds of the genus *Dinornis* and its allies. A communication was read from Mr. W. H. Hudson, C.M.Z.S,, containing an account of the habits of the Pipit (*Anthus correndera*) of the Argentine Republic. A communication was read from Mr. A. G. Butler, F.Z.S., containing a revision of the species of the genus *Protogonis*. A communication was read from Dr. J. E. Gray, F.R.S., on the skulls of some Seals from Japan, with description of a new species, proposed to be called *Eumetopias elongata*. Mr. P. L. Sclater read a paper on some Birds collected in Peru by Mr. H. Whitely, being the seventh of the series of articles upon this subject. A communication was read from Mr. Henry Whitely, C.M.Z.S., containing additional notes on Humming Birds collected in High Peru. A communication was read from Mr. R. Swinhoe, F.Z.S., containing remarks on the Black Albatross with flesh-coloured bill, of the China Seas. Mr. Garrod read a paper on the visceral antomy of the Ground Rat (*Aulacodus swinderianus*.

GEOGRAPHICAL SOCIETY.

NOVEMBER 24TH.—Sir H. Bartle E. Frere, K.C B., President, in the chair—The paper read was, "Recent Discoveries at the Eastern End of New Guinea," by Capt. I. Moresby, R.N. In this paper, forwarded to Sir H. Rawlinson by its author, who is still continuing to cruize in the South Pacific, an account was given of the voyage of H.M.S. *Basilisk* to New Guinea, in the beginning of the present year, undertaken with a view to completing the unfinished survey of the late Capt. Owen Stanley. The following Fellows were elected:—Lieut. W A. D. Acland, C. E. Alforth, J. Allen, H. C. A. Angelo, Lieut. G. G. Baker-Cresswell, H. H Batten, W. T. Blanford, Lieut H. C. Carey, F. D. Chauntrell, S Cheetham, Sir J. Clark, Bart, K. Cochrane, J. Constable, E. A. de Cosson, G. P. Craufurd, Chief Justice P. Daley, Rev. R. V. F. Davies, W. Elmslie, J. Farmer, W. F. Forbes, T. Forshaw, E. W. Foss, J. L Geiger, J Gibbs, A L. Gordon, W. E Heeley, C. J. Hegan, W. H. Hirst, Rev. J. Jones, W. Jones, Col. J P. Kennedy, J. D. Lee, T. Letts, T. Lovell, Col. R. G. A. Luard, Sir F. Lycett, W, Macaulay, A. MacEachen, W. Mackenzie, M.D., C.B, K. W. A. G. M'Alpin, Commander A. H. Markham, R.N., H. M. Ormerod, E. L. Oxenham, F. A. Philbrick, J. S. Prince, Don M. Gonzalez de la Rosa, E. E. Sabel, Col. W. H. Seymour, Dr. P. Smith, J. Straughton, G. Sutherland, C. Taylor, J. Tomlinson, Hon. G. Turner, W. J. Tyler, L. N. Walford, W. T. Western, and E. H. Winslow.

GEOLOGICAL SOCIETY.

NOVEMBER 19TH.—Professor Ramsay, V.P., in the chair.—Mr. H Francis and the Rev. J. T. C. Gullan were elected Fellows. The following communications were read:—"Supplemental Note on the Anatomy of *Hypsilophodon Foxii*," by Mr. J. W. Hulke; "The Drift-Beds of the North-West of England, Part I, Shells of the Lancashire and Cheshire Low-Level Clay and Sands," by T. M. Reade; and "Note on a Deposit of Middle Pleistocene Gravel near Leyland, Lancashire," by Mr. R D. Darbishire.

CHEMICAL SOCIETY.

NOVEMBER 20TH.—Dr. Odling, President in the chair. A paper "On the Co-efficient of Expansion of Carbon Dissulphide," by J. B. Hannay, was read by the Secretary; Dr. Russell then communicated his researches "On the Action of Hydrogen on Silver Nitrate," giving an account of the precipitation of metallic silver in the crystalline state by means of hydrogen; there were also a note "On the Action of Zinc Chloride on Codeine," by Dr. C. R. A. Wright; "On the Chemical Properties of Ammoniated Ammonia Nitrate," by E. Divers, M.D.; and "On the Analysis of a Meteoric Stone and the Detection of Vandium in it," by R. Apjohn.

METEOROLOGICAL SOCIETY.

NOVEMBER 19TH.—Dr. R. J. Mann, President, in the chair.—Messrs W F. Gwinnell, T. Paulin, and T. H. M. Walrond were elected Fellows; and the names of six candidates were announced. The following papers were read:—"The Thunder-Storm at Brighton on October 8, 1873, and its Effects," by Mr. F E. Sawyer; and "Some Considerations suggested by the Depressions which passed over the British Islands during September, 1873," by Mr. F. Gaster; a discussion then took place "On the best form of Thermometer-Stand." It was resolved that the following conditions should he fulfilied.—1. The contained thermometers must at all times be shielded from the direct rays of the sun. 2. The stand must be so arranged that even if when its own external temperature be raised, the thermometers shall not be thereby affected. 3. As reflected heat must diminish the accuracy with which thermometers indicate air or shade temperature, these disturbing causes should be excluded. 4. The temperature of the air alone being desired, it is necessary that the readings of the thermometers be not affected by radiation to the sky. 5. It being desirable that one pattern of stand be used in all localities, it follows that it should be absolutely independent of all surrounding objects. 6. There must be free access of air round the thermometers. 7. No rain should ever reach the dry-bulb thermometers, for if it does, it improperly lowers their temperature, making them read even lower than the wet-bulb. 8. The stand must also be unaffected by snow, both as a direct fall or from obstructed circulation of air. 9. It is very desirable that the stand require no attention between the hours of observation. 10. It is desirable, but not absolutely necessary, that room be provided for a duplicate set of instruments. 11. The stand should not be costly. 12. It should be capable of easy transmission by rail or otherwise.—The meeting not having the results of the comparison of the observations made with the different stands at Strathfield Turgiss, the discussion was adjourned till after these are published.

THE INSTITUTION OF CIVIL ENGINEERS.

TUESDAY, Nov. 25, 1873.—T. Hawksley, Esq., President, in the chair.—The paper read was an "Account of the Construction and Maintenance of the Harbour at Braye Bay, Alderney," by Mr. Leveson Francis Vernon Harcourt, M.A., M. Inst. C.E.

The harbour at Alderney, designed by the late Mr. James Walker, past-president Inst. C.E., was commenced in 1847. The Admiralty intended, in the first instance, to make only a small harbour, but subsequently gave directions for the enlargement of the scheme. In 1858 the design, then in course of construction, consisted of a harbour of 150 acres, with a depth of water of 3 fathoms and upwards, sheltered to the west and east by two breakwaters. The western breakwater, about 4,700 feet in length, had been constructed, but the eastern breakwater was abandoned, and the harbour was consequently exposed to winds blowing from any quarter between N.N.E. and E.S.E. Westerly winds, however, from which the harbour was well sheltered, were the most frequent and severe in that locality. The western breakwater was exposed to the whole force of the Atlantic, and the effect of the fury of the storms was increased at Alderney by the rapidity of the tides near the island, occasioned by a peculiar confluence of currents in the bay of St. Malo. The breakwater was constructed on the "pierres perdues" system—a mound of rubble-stone being deposited in the line of the proposed work from hopper-barges, towed out by steam-tugs. As soon as the mound was sufficiently consolidated it was surmounted by the superstructure. The stone was obtained from quarries at Mannez, on the north-east side of the island, distant about 2 miles, and was conveyed to the works by a railway. The superstructure consisted of a sea wall and of a harbour wall, 14 feet and 12 feet thick respectively, founded at first at the level of low water, and built without mortar entirely with this stone, the intermediate space being filled with rubble; the batter of the sea wall being 9 inches, and of the harbour wall 4 inches to 1 foot. To protect the lower or quay level, which was 6 feet above high water, a promenade wall was built on the sea side, about 14 feet high, consisting of two masonry walls set in mortar, with filling between. The outer wall rested on the sea wall, and the inner wall on the rubble filling between the sea and harbour walls; the whole forming the base of the upper or promenade level. As this structure proved liable to damage by storms the design was modified, in 1849, at 410 feet from the shore. The foundations of the sea wall were then commenced at 12 feet below low water, with a width of 23 feet at the base; the first five courses, each 3 feet thick, being composed of Portland cement concrete blocks, faced with granite headers, each course having a set off of 1 foot on the face. The upper portion of the sea wall was built of Mannez stone set in Medina cement, with a batter of 6 inches to 1 foot, and the width of the wall was increased 9 feet at low water level. The harbour wall was founded 9 feet below low water, and was 14 feet wide at the bottom. The first four courses were composed of Portland cement concrete blocks; the rest of the wall was built of Mannez stone set in cement, the batter of the face throughout being 4 inches in a foot. At the back the walls were carried up vertically, the space of 21 feet between them being filled with concreted hearting. The promenade wall was built of solid masonry in mortar, and both the upper and the lower roadways were paved with granite pitching and copings. and a line of rails was laid down on each level. The quay level was 6 feet above high water and 25 feet wide, and the upper level 14 feet higher and 14 feet wide.

The base was always carried out considerably in advance of the superstructure, so that three or four years could be allowed for settlement before building the superstructure upon it. Staging was erected in the line of the work, supported on round piles, which were buried a few feet in the base. The lower courses were then brought up to low water level, by divers, in lengths of about 60 feet. During each spring tide, in favourable weather, between April and September, the structure was raised nearly up to quay level. At the close of each season's work, a strong cross wall was built at the end to protect it during the winter, and the upper portions were completed in the winter months. The foreshore was raised, on the sea side, by tipping large stones over the wall, so as to protect the sea wall up to low water; and the harbour foreshore was raised to about 6 feet below low water close to the wall.

In 1860, when the superstructure had been carried out 2,700 feet from the shore, the design was somewhat modified. The breakwater was narrowed by reducing the width of the quay to 20 feet, the batter on the sea face was altered to 4 inches in a foot, solid masonry was substituted for the concreted hearting, and the foundations of the harbour wall were commenced at the same level as the sea wall. The head was built in 1864. The foundations were laid 24 feet below low water level, across the whole width of the breakwater. The first nine courses, each 3 feet thick, consisted of concrete blocks faced with granite headers; the upper portion was built of masonry in cement. The most exposed face stones were joggled and dowelled together, and several of the corner quoins were further secured by iron bars and diagonal straps. Two red leading lights on the shore marked the entrance to the harbour at night.

The work of maintenance had proved very difficult, owing to the great force of the sea. The superstructure had been damaged several times by storms during the winter months, but the breaches had in every instance been repaired in the following summer. The foreshore had also constantly been lowered near the sea face of the breakwater by the sea, and had only been maintained by continual deposits of stone.

The cost of the works of construction and of maintenance, to 1872, had amounted to £1,274,200, of which £57,200 had been expended in repairs. The harbour was transferred from the Admiralty to the Board of Trade in 1866. The engineers who successively had charge of the works were—as Engineers-in-chief, Messrs. Walker, Burges and Cooper, Messrs. McClean and Stileman, and Sir John Hawkshaw; and as Resident Engineers, Mr. Parkes, Mr. Rhodes, Mr. May, and the Author. The contractors for the whole of the works were Messrs. Jackson and Bean.

The breakwater at Alderney, lying open to the west, was exposed to a far heavier sea than St. Catherine's breakwater on the east side of the island of Jersey. St. Catherine's breakwater, though built similarly to the original design for the Alderney breakwater, and stretching more than 2,000 feet into the sea, had been maintained at a very slight expense, and no foreshore had been deposited on the mound since the completion of the works in 1856. Besides being exposed to a very heavy sea, the outer portion of the Alderney breakwater was built in an unusual depth of water, reaching at the head to a depth of 130 feet below low water of ordinary spring tides, or to three times the extreme depth of the foundations of the breakwaters at Cherbourg and at Plymouth. The settlement of the superstructure on the huge mound, amounting to about 1-20th of the height of the mound, caused cracks in the masonry between the work of different seasons, which, though made good as far as possible, formed weak points to the attacks of the sea. The great recoil also of the waves from the high sea wall increased the force of the sea, drew away the foreshore from the wall, and helped to loosen the face stones. The damaging effects of the sea were not fully experienced till the work was completed, otherwise probably the evils might have been in a great measure averted by a modification of the design. To have carried the foundations lower, and to have made them level in cross section, with no structure above the quay level, and less batter on the sea face, would have strengthened the structure. But whether the Government would have sanctioned a considerable increase in expense was doubtful, and at the time of the latest modifications there were no sufficient reasons to justify such a change.

From a series of soundings taken by the Author in 1870, 1871 and 1872, it appeared that the rubble mound tended to assume a slope of 7 to 1 from the sea wall down to about 20 feet below low water of spring tides, changing at that depth to a slope of $1\frac{1}{2}$ to 1. In shallow water the change of slope took place about 15 feet below low water, but the lower slope was flatter.

The mound was liable to be disturbed by the sea as far as 80 feet or 90 feet from the wall on the sea side, and to a depth of 20 feet below low water. Beyond those limits, which applied to the outer portion of the breakwater, all action of the sea ceased. The limit of depth varied with the depth of water in which the mound was situated, but the limit of distance remained approximately constant throughout the whole length of the breakwater.

APPLICATIONS FOR LETTERS PATENT.

(*Continued from page 2.*)

paratus for the purpose.—G. Haseltine. Electro-magnetic railway signal apparatus (com). (Complete specification).—A. M. Silber and J. F. C. Farquhar. Construction of lamps and lanterns or similar apparatus used for lighting purposes, and apparatus for heating purposes.—J. Gray, Knt., M.P., and E. W. D. Gray. Apparatus for preparing paper for printing. H. P. Buchan. Water closets.—F. Wirth. Malt kins (com.)—J. Peel and S. Emsley. Pickers used in weaving.—W. Henderson. Apparatus for shunting railway trains.—W. Jones. Apparatus regulating the temperature of manufactories, conservatories, and other apartments or buildings.

On October 11th.—3298 to 3312.—J. Paterson and J. Ritchie. Apparatus for fixing capsules on bottles.—W. Cluzet and A. Simon. Rules for drawing.—E. Loomes. Manufacture of boxes, more especially adapted or suitable for matches, splints, cigarettes, bonbons, and other analogous articles.—H. Smith. Carving forks.—J. J. Ney. Sliding cramp for boots, shoes, and other articles having two or more parallel edges, and for bringing same together.—R. Guthrie. Lamps for burning paraffin and other hydrocarbon oils.—W. Tongue. Machinery for combing fibrous materials.—W. Bamber. Gas burner to be employed for gassing yarn.—T. H. Waugh and J. T. Waugh. Machinery for spinning and for doubling fibres.—W. Henderson. Signal apparatus to be applied to railways.—H. E. Newton. Mode of connecting gas, water, or other pipes (com.)—A. Fleury. Method of and appliances for determining the course or direction of bodies in air and water.—W. A. White. Combinations of ingredients for cleansing and bleaching wools and other suitable fibres and fabrics, paintwork, floors, casks, and other articles and utensils (com.)—J. Ellis. Arranging, planning, and constructing dwelling-houses.—**W. A.** Lyttle. Candles.

Dr. CARMICHAEL's letter, further explaining his invention of "Anti-Wave Motion Ships," and Mr. J. NAPIER's letter on "Tidal Engines," we are compelled to postpone till our next issue.

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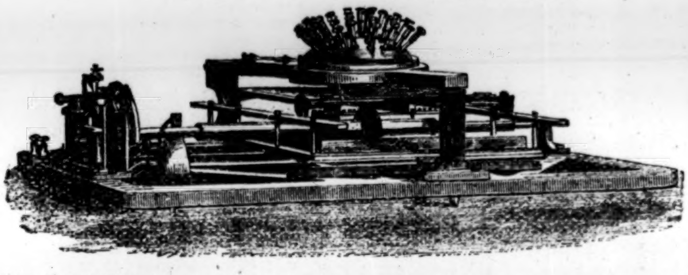

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